Unit 17

PRACTICAL GEOMETRY-TRIANGLES

Exercise 17.1

1. Construct a ΔABC, in which:

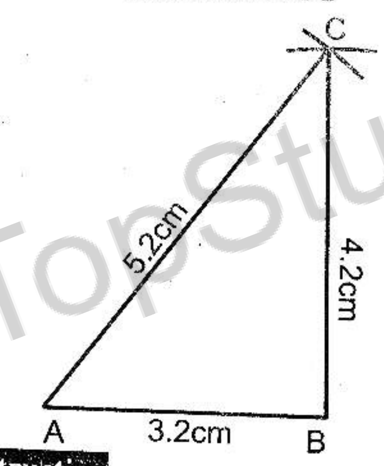
(i) $m\overline{AB} = 3.2cm$, $m\overline{BC} = 4.2cm$, $m\overline{CA} = 5.2cm$

Given

The sides $m\overline{AB} = 3.2cm$, $m\overline{BC} = 4.2cm$, $m\overline{CA} = 5.2cm$ of ΔABC

Required

To construct the ΔABC



Construction

(i) Draw a line segment $m\overline{AB} = 3.2cm$

(ii) With centre B and radius 4.2cm, draw an arc.

(iii) With centre A and radius 5.2cm, draw another arc which meet previous arc at point C.

(iv) Join C to B and A.

Then ABC is the required Δ.

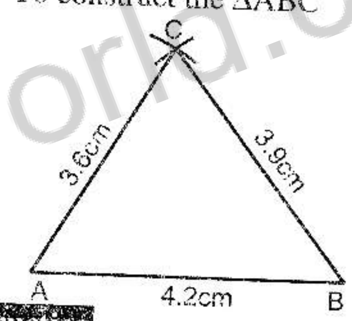
(ii) $m\overline{AB} = 4.2cm, m\overline{BC} = 3.9cm$, $m\overline{CA} = 3.6cm$

Given

The sides $m\overline{AB} = 4.2cm$, $m\overline{BC} = 3.9cm$, $m\overline{CA} = 3.6cm$ of ΔABC

Required

To construct the ΔABC



Construction

(i) Draw a line segment $m\overline{AB} = 4.2cm$

(ii) With centre B and radius 3.9cm, draw an arc.

(iii) With centre A and radius 3.6cm, draw another arc which meet previous arc at point C.

(iv) Join A to C and B to C.

Then ABC is the required Δ.

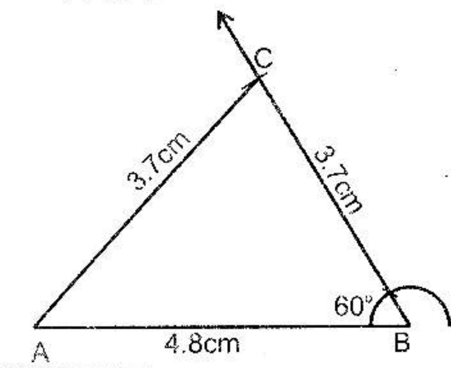
(iii) $m\overline{AB} = 4.8cm$, $m\overline{BC} = 3.7cm$, $m\angle B = 60^\circ$

Given

The sides $m\overline{AB} = 4.8cm$, $m\overline{BC} = 3.7cm$ and $m\angle B = 60^\circ$ of ΔABC

Required

To construct the ΔABC



Construction

(i) Draw a line segment $m\overline{AB} = 4.8cm$

(ii) At the end point B of $\overline{AB}$ make $m\angle B = 60^{\circ}$.

(iii) Cut off $m\overline{BC} = 3.7cm$ from the terminal side of $\angle 60^{\circ}$.

(iv) Join AC

Then ABC is the required Δ.

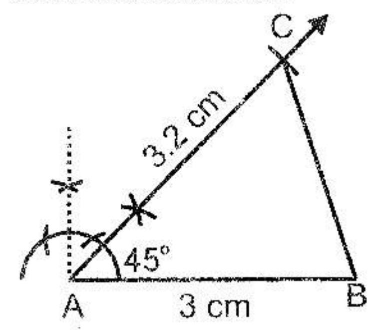
(iv) $m\overline{AB} = 3cm$, $m\overline{AC} = 3.2cm$, $m\angle A = 45^{\circ}$.

Given

The sides $m\overline{AB} = 3cm$, $m\overline{AC} = 3.2cm$ and $m\angle A = 45^{\circ}$ of ΔABC

Required

To construct the ΔABC



Construction

(i) Draw a line segment $m\overline{AB} = 3cm$.

(ii) At the end point A of $\overline{AB}$ make $m\angle A = 45^{\circ}$.

(ii) Cut off $m\overline{AC} = 3.2cm$ from the terminal side of $\angle 45^{\circ}$.

(iv) Join BC

Then ABC is the required Δ.

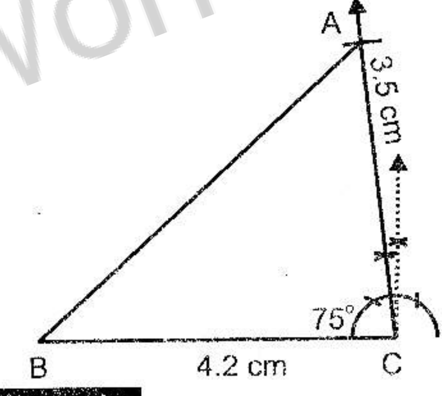
(v) $m\overline{BC} = 4.2cm$, $m\overline{CA} = 3.5cm$, $m\angle C = 75^{\circ}$

Given

The sides $m\overline{BC} = 4.2cm$, $m\overline{CA} = 3.5cm$ and $m\angle C = 75^{\circ}$ of ΔABC

Required

To construct the ΔABC



Construction

(i) Draw a line segment $m\overline{BC} = 4.2cm$.

(ii) At the end point C of $\overline{BC}$ make $m\angle C = 75^{\circ}$.

(iii) Cut off $m\overline{AC} = 3.5cm$ from the terminal side of $\angle 75^{\circ}$.

(iv) Join AB.

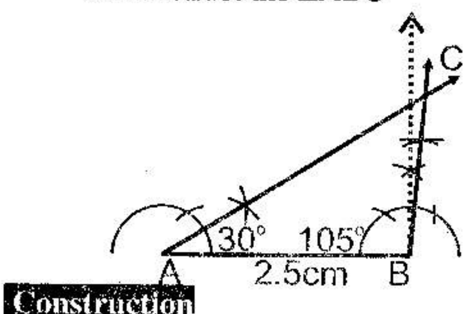
Then ABC is the required Δ.

(vi) $m\overline{AB} = 2.5cm$, $m\angle A = 30^{\circ}$, $m\angle B = 105^{\circ}$.

The side $m\overline{AB} = 2.5cm$ and angles $m\angle A = 30^\circ, m\angle B = 105^\circ$ of ΔABC

Required

To construct the ΔABC



Construction

(i) Draw the line segment $m\overline{AB} = 2.5cm$.

(ii) At the end point A of $\overline{AB}$ make $\angle A = 30^\circ$.

(iii) At the end point B of $\overline{AB}$ make $m\angle B = 105^\circ$.

(iv) The terminal sides of these two angles meet in C.

Then ABC is required Δ.

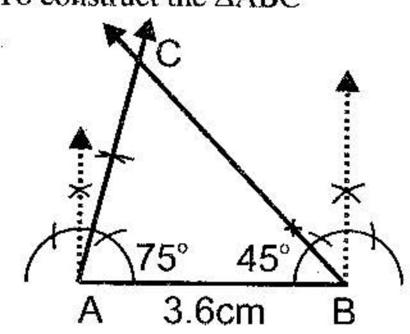
(vii) $m\overline{AB} = 3.6cm, m\angle A = 75^\circ$, $m\angle B = 45^\circ$.

Given

The side $m\overline{AB} = 3.6cm$ and angles $m\angle A = 75^\circ$, $m\angle B = 45^\circ$ of ΔABC

Required

To construct the ΔABC



(i) Draw the line segment $m\overline{AB} = 3.6cm$.

(ii) At the end point A of $\overline{AB}$ make $m\angle A = 75^\circ$.

(iii) At the end point B of $\overline{AB}$ make $m\angle B = 45^\circ$.

(iv) The terminal sides of these two angles meet at C.

Then ABC is the required Δ.

Q.2. Construct a Δ xyz in which

(i) $m\overline{YZ} = 7.6cm, m\overline{XY} = 6.1cm$, $m\angle X = 90^\circ$.

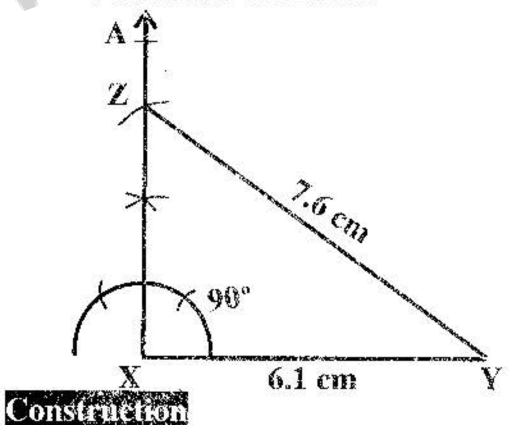
Given

The sides

$m\overline{YZ} = 7.6cm, m\overline{XY} = 6.1cm$ and **$m\angle X = 90^\circ$ of ΔXYZ.**

Required

To construct the ΔXYZ



Construction

(i) Draw the line segment $m\overline{XY} = 6.1cm$

(ii) At the end point X of $\overline{XY}$ make $m\angle X = 90^\circ$.

(iii) With Y as centre and radius 7.6cm, draw an arc which cut terminal side of $\angle 90^\circ$ at point Z.

(iv) Join ZY.

Then XYZ is the required Δ.

(ii) **$m\overline{ZX} = 6.4cm$, $m\overline{YZ} = 2.4cm$, $m\angle Y = 90^\circ$**

Given

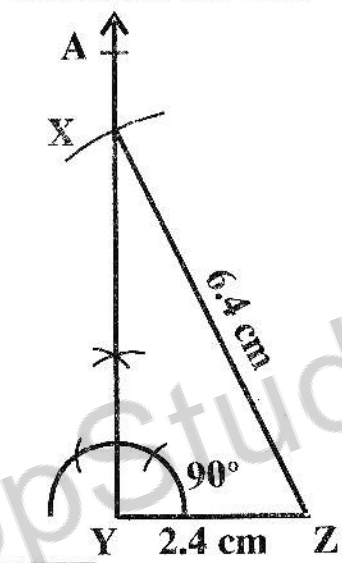
The sides

$m\overline{ZX} = 6.4cm, m\overline{YZ} = 2.4cm$ and

$m\angle Y = 90^\circ$ of **ΔXYZ.**

Required

To construct the ΔXYZ



Construction

(i) Draw the line segment $m\overline{YZ} = 2.4cm$

(ii) At the end point Y of $\overline{YZ}$ make $m\angle Y = 90^\circ$.

(iii) With Z as centre and radius 6.4cm draw an arc which cut terminal side of $\angle 90^\circ$ at point X.

(iv) Join XZ.

Then XYZ is the required Δ.

(iii) $m\overline{XY} = 5.5cm, m\overline{ZX} = 4.5cm$, $m\angle Z = 90^\circ$

Given

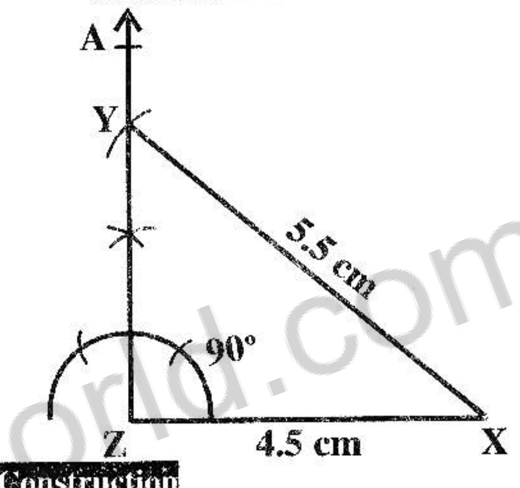
The sides

$m\overline{XY} = 5.5cm, m\overline{ZX} = 4.5cm$ and

$m\angle Z = 90^\circ$ of ΔXYZ.

Required

To construct the ΔXYZ



Construction

(i) Draw a line segment $m\overline{ZX} = 4.5cm$

(ii) At the end point Z of $\overline{ZX}$ make $m\angle Z = 90^\circ$.

(iii) With X as centre and radius 5.5cm draw an arc which cut terminal side of $\angle 90^\circ$ at point Y

(iv) Join XY.

Then XYZ is the required Δ.

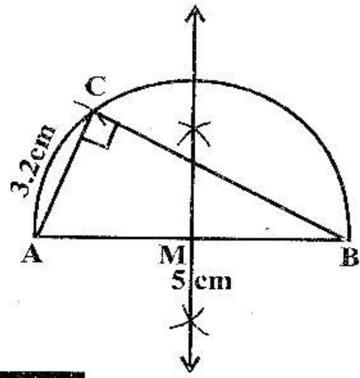
Q.3. Construct a right angled Δ measure of whose hypotenuse is 5cm and one side is 3.2cm.

Given

In right angled Δ hypotenuse is 5cm and one side is 3.2cm

Required

To construct the ΔXYZ



Construction

(i) Draw a line segment $m\overline{AB} = 5cm$.

(ii) With $\overline{AB}$ as diameter, draw a semi circle.

(iii) With A as center draw an arc of radius 3.2cm cutting the semi circle in C.

(iv) Join C with A and B.

Therefore ABC is required triangle with $\angle C=90^\circ$

Q.4 Construct a right angled isosceles triangle. Whose hypotenuse is:

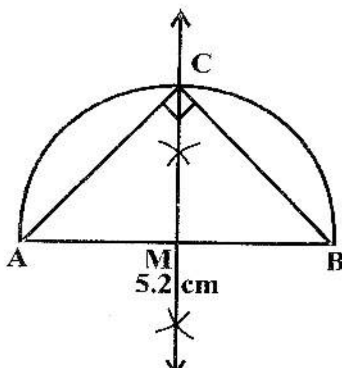
i) Hypotenuse 5.2cm long

Given

In right angled isosceles triangle hypotenuse is 5.2 cm.

Required

To construct right angled isosceles triangle



Construction

(i) Take $m\overline{AB} = 5.2cm$.

(ii) Find mid-point M of $\overline{AB}$.

(iii) With centre as M and radius $m\overline{AM} = m\overline{MB}$ draw a semi circle which intersects the bisector in C.

(iv) Join A to C and B to C.

Then ΔABC is the required right angled isosceles triangle with $\angle C = 90^\circ$

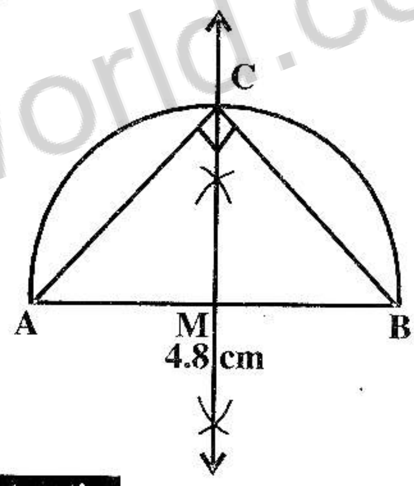
(ii) Hypotenuse 4.8 cm

Given

In right angled isosceles triangle hypotenuse is 4.8 cm.

Required

To construct right angled isosceles triangle.



Construction

(i) Take $m\overline{AB} = 4.8cm$.

(ii) Find mid-point M of $\overline{AB}$.

(iii) With centre as M and radius $m\overline{AM} = m\overline{MB}$ draw a semi circle which intersects the bisector in C.

(iv) Join A to C and B to C.

Then ΔABC is the required right angled isosceles triangle with $\angle C = 90^\circ$

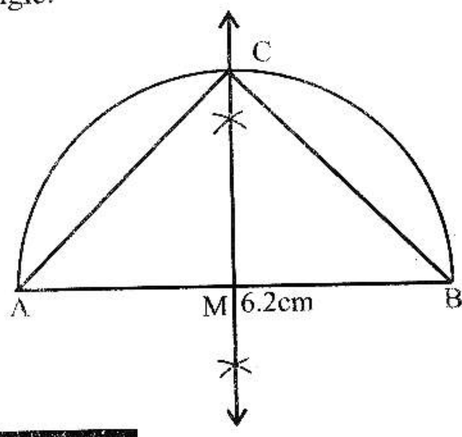
(iii) Hypotenuse 6.2 cm

Given

In right angled isosceles triangle hypotenuse is 6.2 cm.

Required

To construct right angled isosceles triangle.



Construction

(i) Take $m\overline{AB} = 6.2cm$.

(ii) Find mid-point M of AB.

(iii) With centre as M and radius $m\overline{AM} = m\overline{MB}$ draw a semi circle which intersects the bisector in C.

(iv) Join A to C and B to C.

Then ΔABC is the required right angled isosceles triangle with $\angle C = 90^\circ$

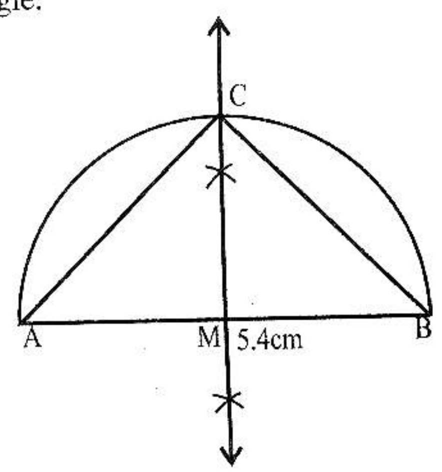
(iv) Hypotenuse 5.4 cm

Given

In right angled isosceles triangle hypotenuse is 5.4 cm.

Required

To construct right angled isosceles triangle.



Construction

(i) Take $m\overline{AB} = 5.4cm$.

(ii) Find mid-point M of AB.

(iii) With centre as M and radius $m\overline{AM} = m\overline{MB}$ draw a semi circle which intersects the bisector in C.

(iv) Join A to C and B to C.

Then ΔABC is the required right angled isosceles triangle with $\angle C = 90^\circ$

Q.5. (Ambiguous case) construct a ΔABC in which

(i) $m\overline{AC} = 4.2cm, m\overline{AB} = 5.2cm$, $m\angle B = 45^\circ$.

Given

In ΔABC $m\overline{AC} = 4.2cm, m\overline{AB} = 5.2cm$, $m\angle B = 45^\circ$.

Required

To construct ΔABC

Construction

(i) Draw a line segment $m\overline{AB} = 5.2cm$.

(ii) At the end point B of $\overline{BA}$ make $m\angle B = 45^\circ$.

(iii) With centre A and radius 4.2cm draw an arc which cuts $\overline{BD}$ in two distinct points C and C′.

(iv) Join AC and AC′.

$\therefore$ ΔABC and $\Delta ABC'$ are required triangles.

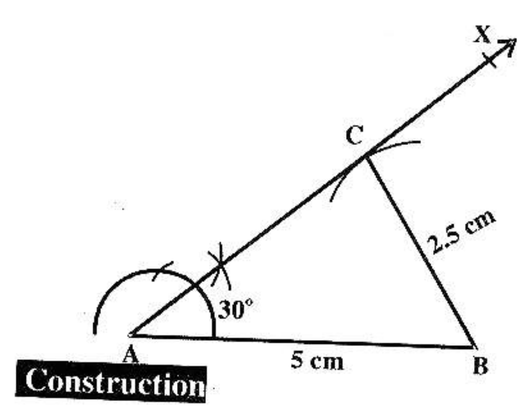
(ii) $m\overline{BC} = 2.5cm$, $m\overline{AB} = 5.0cm$, $m\angle A = 30^\circ$.

Given

In ΔABC $m\overline{BC} = 2.5cm$, $m\overline{AB} = 5.0cm$, $m\angle A = 30^\circ$.

Required

To construct ΔABC



Construction

(i) Take $m\overline{AB} = 5cm$.

(ii) At the end point A of $\overline{AB}$ make $m\angle A = 30^\circ$.

(iii) With centre B and radius 2.5cm draw an arc which touches $\overrightarrow{AX}$ at point C.

(iv) Join BC.

$\therefore$ ΔABC is required triangle.

Exercise 17.2

1. Construct the following Δ's ABC. Draw the bisectors of their angles and verify their concurrency.

(i) $m\overline{AB} = 4.5cm$, $m\overline{BC} = 3.1cm$, $m\overline{CA} = 5.2cm$.

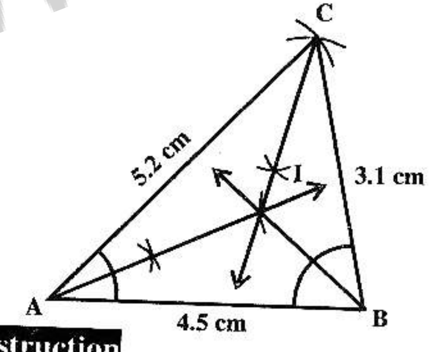
Given

The sides $m\overline{AB} = 4.5cm$, $m\overline{BC} = 3.1cm$, and $m\overline{CA} = 5.2cm$.

Required

(i) To construct ΔABC.

(ii) To draw its angle bisectors and verify their concurrency.



Construction

(i) Take $m\overline{AB} = 4.5cm$.

(ii) With A as centre and radius 5.2cm draw an arc.

(iii) With B as centre and radius 3.1cm draw another arc which intersect the first arc at C.

(iv) Join AC and BC to complete the ΔABC.

(v) Draw bisectors of $\angle A, \angle B$ and $\angle C$ meeting each other in the point I.

Hence angle bisectors of the ΔABC are concurrent at I which lies within the triangle.

(ii) **$m\overline{AB} = 4.2cm, m\overline{BC} = 6cm$, $mCA = 5.2cm$**

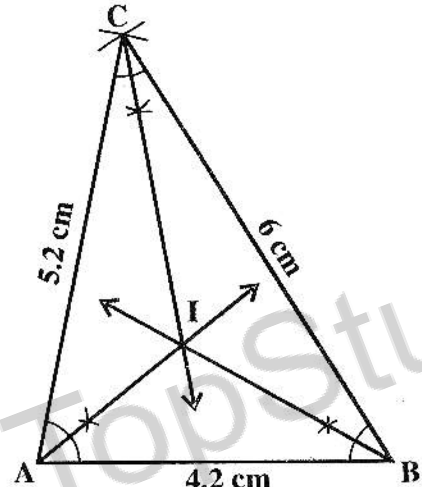
Given

The sides $m\overline{AB} = 4.2cm$, $m\overline{BC} = 6cm$, $m\overline{CA} = 5.2cm$ of a ΔABC.

Required

(i) To construct ΔABC.

(ii) To draw its angle bisectors and verify their concurrency.



Construction

(i) Take $m\overline{AB} = 4.2cm$.

(ii) With A as centre and radius 5.2cm draw an arc.

(iii) With B as centre and radius 6cm draw another arc which intersect the first arc at C.

(iv) Join BC and AC to complete the ΔABC.

(v) Draw bisectors of $\angle A, \angle B$ and $\angle C$ meeting each other in the point I . Hence angle bisectors of the ΔABC are concurrent at I which lies within the triangle.

(iii) **$m\overline{AB} = 3.6cm, m\overline{BC} = 4.2cm$, $m\angle B = 75^{o}$.**

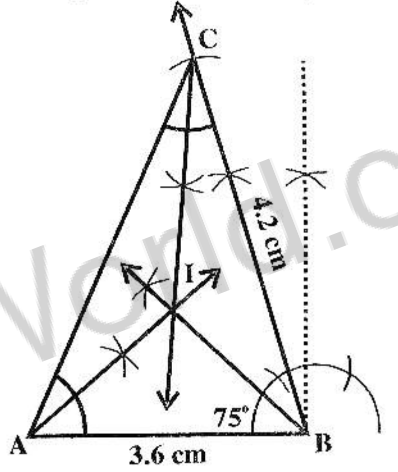
Given

The sides $m\overline{AB} = 3.6cm$, $m\overline{BC} = 4.2cm$ and $m\angle B = 75^{o}$ of ΔABC

Required

(i) To construct ΔABC.

(ii) To draw its angle bisectors and verify their concurrency.



Construction

(i) Take $m\overline{AB} = 3.6cm$.

(ii) At B draw angle of 75°

(iii) With B as centre and radius 4.2cm draw arc which intersect terminal arm of 75° in C.

(iv) Join AC to complete the ΔABC.

(v) Draw bisectors of $\angle A, \angle B$ and $\angle C$ meeting each other in the point I.

Hence angle bisectors of the ΔABC are concurrent at I which lies within the triangle.

Q.2. Construct Δs PQR. Draw their altitudes and show that they are concurrent.

(i) **$m\overline{PQ} = 6cm, m\overline{QR} = 4.5cm,$ $m\overline{PR} = 5.5cm.$**

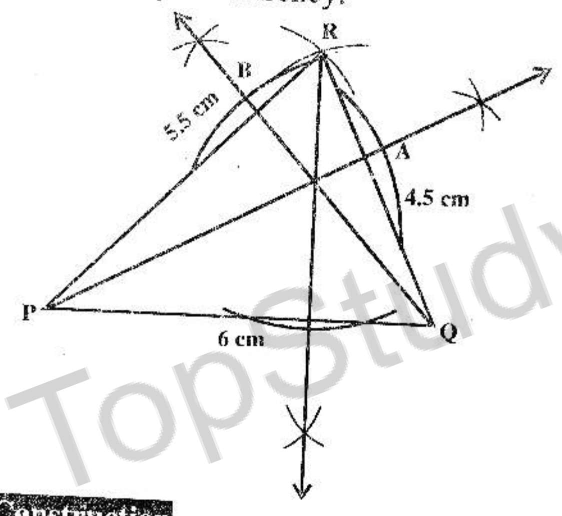
Given

The sides $m\overline{PQ} = 6cm$, $m\overline{QR} = 4.5cm$ and $m\overline{PR} = 5.5cm$ of a ΔPQR.

Required

(i) To construct Δ PQR.

(ii) To draw its altitudes and verify their concurrency.



Construction

(i) Take $m\overline{PQ} = 6cm$

(ii) With P as centre draw an arc of radius 5.5 cm.

(iii) With Q as centre draw an arc of radius 4.5cm, cutting the first in R.

(iv) Join R with P and Q.

(v) Draw the altitudes on, $\overline{PR}, \overline{QR}$ and $\overline{PQ}$ which cut each other in I.

(vi) All altitudes are concurrent.

(ii) **$m\overline{PQ} = 4.5cm, m\overline{QR} = 3.9cm,$ $m\angle R = 45°.$**

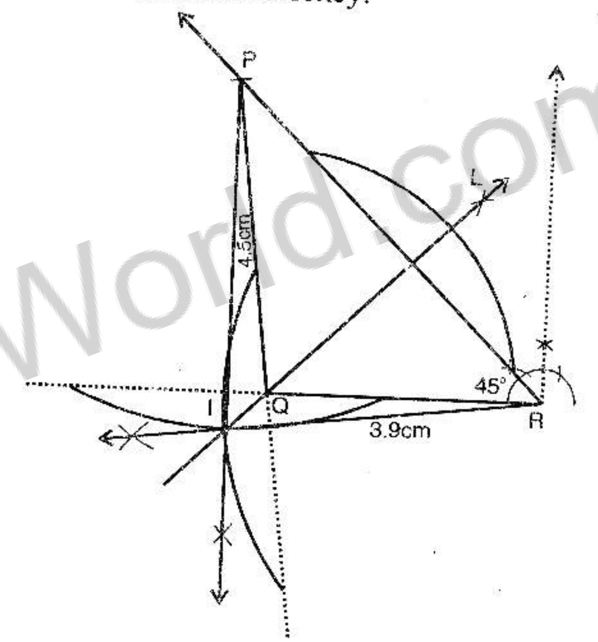
Given

The sides $m\overline{PQ} = 4.5cm$, $m\overline{QR} = 3.9cm$ and $m\angle R = 45°$ of Δ PQR

Required

(i) To construct Δ PQR.

(ii) To draw its altitudes and verify their concurrency.



Construction

(i) Draw $\overline{QR}$ = 3.9cm.

(ii) Make $\angle R = 45°$

(iii) Cut $\overline{QP} = 4.5cm$ join PQ, ΔPQR is formed.

(iv) Draw altitudes on $\overline{PR}$, $\overline{QR}$ and $\overline{PQ}$ they cut each other in I.

The altitudes are concurrent.

(iii) $\mathbf{m\overline{RP} = 3.6cm, m\angle Q = 30^o}$,

$\mathbf{m\angle P = 105^o}$.

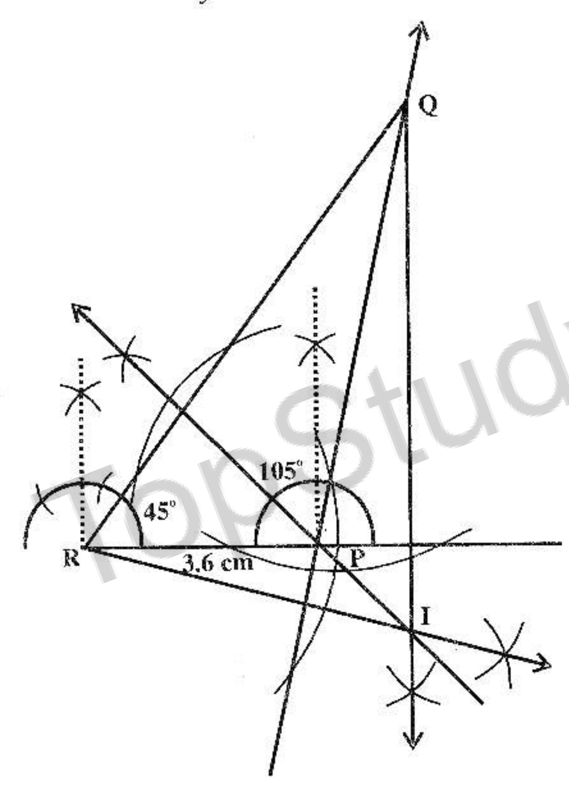
Given

$m\overline{RP} = 3.6cm, m\angle Q = 30^o$, $m\angle P = 105^o$.

Required

(i) To construct Δ PQR.

(ii) To draw its altitudes and verify their concurrency.



Construction

$$m\angle P + m\angle Q + m\angle R = 180^o$$
$$105^o + 30^o + m\angle R = 180^o$$
$$135^o + m\angle R = 180^o$$
$$m\angle R = 180^o - 135^o = 45^o$$

(i) Take $m\overline{RP} = 3.6cm$.

(ii) At P draw an angle of 105°.

(iii) At R draw an angle of 45°.

(iv) Terminal arms of both angles meet in point Q. It form Δ PQR.

(v) Draw the altitudes, of $\overline{PQ}$ and $\overline{QR}$ and $\overline{RP}$ cutting each other in I.

The altitudes are concurrent.

Q.3. Construct the following triangles ABC. Draw the perpendicular bisectors of their sides and verify their concurrency. Do they meet inside the triangle.

(i) $\mathbf{m\overline{AB} = 5.3cm}$, $\mathbf{m\angle A = 45^o}$,

$\mathbf{m\angle B = 30^o}$

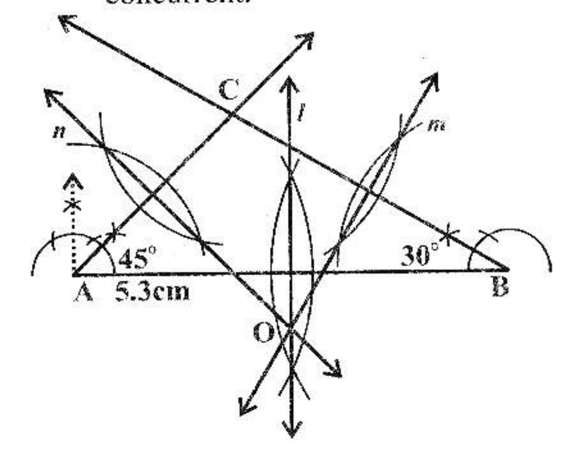
Given

Side $m\overline{AB} = 5.3cm$ and $m\angle A = 45^o$, $m\angle B = 30^o$ of a ΔABC.

Required

(i) To construct the ΔABC.

(ii) To draw perpendicular bisectors of its sides and to verify that they are concurrent.



Construction

(i) Take $m\overline{AB} = 5.3cm$

(ii) At the end point A of $\overline{AB}$ make $m\angle A = 45^o$.

(iii) At the end point B of $\overline{AB}$ make $m\angle B = 30^o$.

(iv) The terminal sides of these two angles meet at C.
Then ABC is required Δ.

(v) Draw perpendicular bisectors of $\overline{AB}, \overline{BC}$ and $\overline{CA}$ meeting each other in the point O.

Hence the three perpendicular bisectors of sides of ΔABC are concurrent at O.

(ii) $m\overline{BC} = 2.9cm$, $m\angle A = 30^o$, $m\angle B = 60^o$

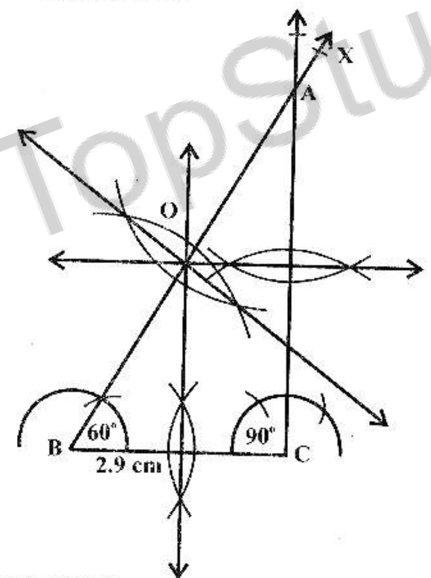
Given

The side $m\overline{BC} = 2.9cm$, $m\angle A = 30^o$ and $m\angle B = 60^o$ of ΔABC.

Required

(i) To construct the ΔABC.

(ii) To draw perpendicular bisectors of its sides and to verify that they are concurrent.



Construction

$$m\angle A + m\angle B + m\angle C = 180^o$$
$$30^o + 60^o + m\angle C = 180^o$$
$$90^o + m\angle C = 180^o$$
$$m\angle C = 90^o.$$

(i) Take $m\overline{BC} = 2.9cm$

(ii) At the end point B of $\overline{BC}$ make $m\angle B = 60^o$.

(iii) At the end point C of $\overline{BC}$ make $m\angle C = 90^o$.

(iv) The terminal sides of these two angles meet in A.

Then ABC is required Δ.

(v) Draw perpendicular bisectors of $\overline{AB}, \overline{BC}$ and $\overline{CA}$ meeting each other in the point O.

Hence the three perpendicular bisectors of sides of ΔABC are concurrent at O.

(iii) $m\overline{AB} = 2.4cm, m\overline{AC} = 3.2cm$, $m\angle A = 120^o$

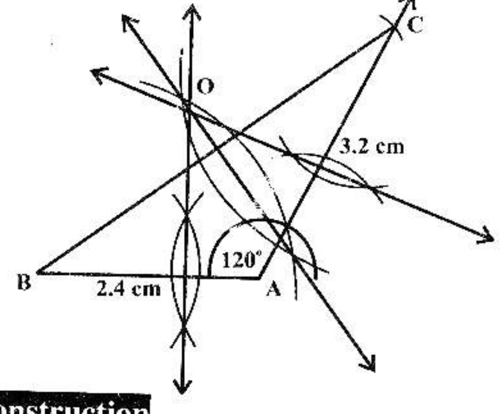
Given

The sides $m\overline{AB} = 2.4cm$, $m\overline{AC} = 3.2cm$ $m\angle A = 120^o$ of a ΔABC

Required

(i) To construct the ΔABC.

(ii) To draw perpendicular bisectors of its sides and to verify that they are concurrent.



Construction

(i) Take $m\overline{AB} = 2.4cm$

(ii) At the end point A of $\overline{AB}$ make $m\angle A = 120^o$.

(iii) With centre A, draw an arc of radius 3.2cm which cut terminal arm of $\angle A$ at C.

(iv) Join B to C

Then ABC is required Δ.

(v) Draw perpendicular bisectors of $\overline{AB}, \overline{BC}$ and $\overline{CA}$ meeting each other at the point O.

Hence the three perpendicular bisectors of sides of ΔABC are concurrent at O.

Q.4. Construct following Δ's XYZ. Draw their three medians and show that they are concurrent.

(i) $m\overline{YZ} = 4.1cm$, $m\angle Y = 60^o$ and $m\angle X = 75^o$

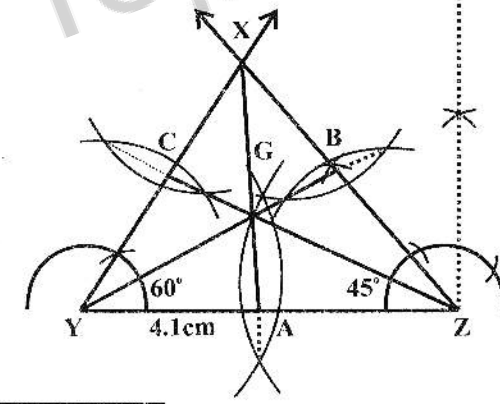
Given

The side $m\overline{YZ} = 4.1cm$, $m\angle Y = 60^o$ and $m\angle X = 75^o$

Required

(i) Construct the ΔXYZ.

(ii) Draw its medians and verify their concurrency.



Construction

$$m\angle X + m\angle Y + m\angle Z = 180^o$$

$$75^o + 60^o + m\angle Z = 180^o$$

$$135^o + m\angle Z = 180^o$$

$$m\angle Z = 180^o - 135^o$$

$$m\angle Z = 45^o.$$

(i) Take $m\overline{YZ} = 4.1cm$.

(ii) At the end point y of $\overline{YZ}$ make $m\angle Y = 60^o$.

(iii) At the end point Zof $\overline{ZY}$ make $m\angle Z = 45^o$

(iv) The terminal sides of these angles meet at X. Then XYZ is required Δ.

(v) Draw perpendicular bisectors of the sides $\overline{YZ}$, $\overline{ZX}$ and $\overline{XY}$ of ΔXYZ and make their midpoints A, B and C respectively.

(vi) Join Y to midpoint B to get median $\overline{YB}$.

(vii) Join Z to midpoint C to get median $\overline{ZC}$.

(viii) Join X to mid point A to get median $\overline{AX}$.The medians of ΔXYZ pass through the same point G.

All medians intersect at point G.

Hence medians are concurrent at G.

(ii) $m\overline{XY} = 4.5cm$, $m\overline{YZ} = 3.4cm$, $m\overline{ZX} = 5.6cm$

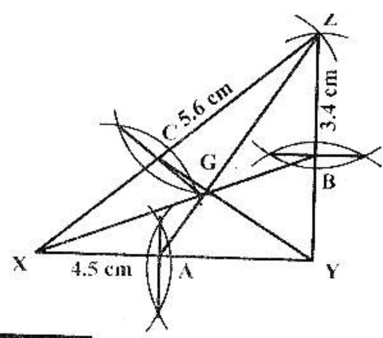
Given

The sides $m\overline{XY} = 4.5cm$, $m\overline{YZ} = 3.4cm$ and $m\overline{ZX} = 5.6cm$ of a ΔXYZ.

Required

(i) Construct the ΔXYZ.

(ii) Draw its medians and verify their concurrency.



Construction

(i) Take $m\overline{XY} = 4.5cm$.

(ii) With Y as centre and radius 3.4 cm draw an arc.

(iii) With X as centre and radius 5.6cm draw another arc cutting first in Z join Z to Y and X to Z.

(iv) Draw perpendicular bisectors of the sides $\overline{XY}$, $\overline{YZ}$ and $\overline{XZ}$ of ΔXYZ and make their midpoints A,B and C respectively.

(v) Join X to mid point B to get median $\overline{XB}$.

(vi) Join Y to midpoint C to get medians $\overline{YC}$.

(vii) Join Z to midpoint A to get median $\overline{ZA}$.

All medians intersect at point G.

Hence medians are concurrent at G.

(iii) $m\overline{ZX} = 4.3cm, m\angle X = 75^\circ$ and $m\angle Y = 45^\circ$.

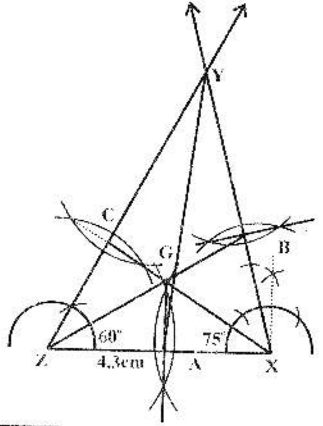
Given

The side $m\overline{ZX} = 4.3cm$, $m\angle X = 75^\circ$ and $m\angle = 45^\circ$ of ΔXYZ.

Required

(i) Construct the ΔXYZ.

(ii) Draw its medians and verify their concurrency.



Construction

$$m\angle X + m\angle Y + m\angle Z = 180^\circ$$
$$75^\circ + 45^\circ + m\angle Z = 180^\circ$$
$$m\angle Z + 120^\circ = 180^\circ$$
$$m\angle Z = 180^\circ - 120^\circ$$
$$m\angle Z = 60^\circ$$

(i) Take $m\overline{ZX} = 4.3cm$.

(ii) At the end point Z of $\overline{ZX}$ make $m\angle Z = 60^\circ$.

(iii) At the end point X of $\overline{XY}$ make $m\angle X = 75^\circ$

(iv) The terminal sides of these angles meet at Y. Then XYZ is required Δ.

(v) Draw perpendicular bisectors of the sides $\overline{ZX}$, $\overline{XY}$ and $\overline{YZ}$ of ΔXYZ and make their midpoints A,B and C respectively.

(vi) Join Y to midpoint A to get median $\overline{YA}$.

(vii) Join Z to the midpoint B to get median $\overline{ZB}$.

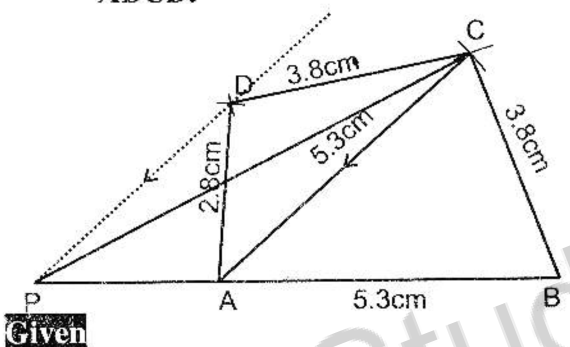
(viii) Join X to the midpoint B to get median $\overline{XC}$.

All medians intersect at point G.
Hence medians are concurrent at G.

Exercise 17.3

1. (i) Construct a quadrilateral ABCD, having $m\overline{AB} = m\overline{AC} = 5.3cm$, $m\overline{BC} = m\overline{CD} = 3.8cm$ and $m\overline{AD} = 2.8cm$.

(ii) On the side BC construct a Δ equal in area to the quadrilateral ABCD.



Given

Sides of quadrilateral ABCD

$m\overline{AB} = m\overline{BC} = 5.3$ cm

$m\overline{BC} = m\overline{CD} = 3.8$ cm

$m\overline{AD} = 2.8$ cm

Required

i) To make the quadrilateral ABCD.

ii) On the side $\overline{BC}$ construct a Δ equal in area to the quadrilateral ABCD.

Construction

(i) Take $m\overline{AB} = 5.3$ cm.

(ii) With centre A and B draw arcs with radii 5.3 cm and 3.8 cm respectively cutting each other in C.

(iii) With C as centre draw an arc of radius 3.8cm, then with A as centre draw an arc of radius 2.8cm cutting the first in D.

(iv) Join AD, DC, BC

ABCD is the required quadrilateral.

(ii)

(i) Draw $\overline{AC}$

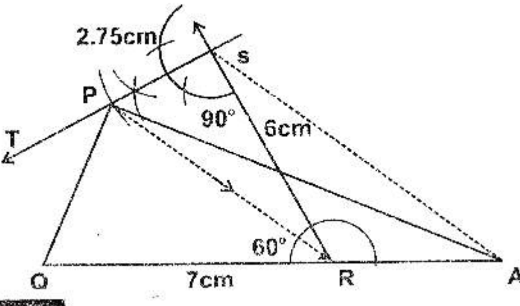
(ii) Through D draw a line || $\overline{AC}$

(iii) Produce $\overline{AB}$ which meet parallel line in P.

(iv) Join P with C

PCB is the required triangle equal in area to quadrilateral ABCD.

2. Construct a Δ equal in area to the quadrilateral PQRS, having $m\overline{QR} = 7cm$, $m\overline{RS} = 6cm$, $m\overline{SP} = 2.75cm$, $m\angle QRS = 60^\circ$ and $m\angle RSP = 90^\circ$.



Given

Parts of the quadrilateral PQRS are given.

Required

(i) To make the quadrilateral PQRS.

(ii) To make a Δ equal in area to the quadrilateral PQRS.

Construction

(i) Take $m\overline{QR} = 7cm$

(ii) Make $\angle QRS = 60^o$

(iii) With R as centre draw an arc of 6 cm radius which cuts terminal arm of $\angle 60^o$ in S.

(iv) Make $\angle RSP = 90^o$

(v) With S as centre draw an arc of 2.75 cm radius which cuts terminal arm of 90° in P.

(vi) Join QP.

PQRS is required quadrilateral.

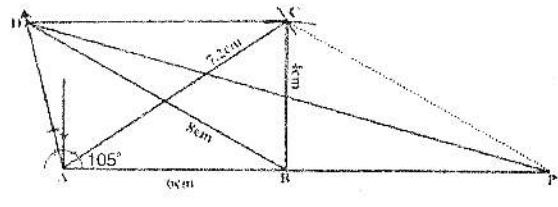
(vii) Join PR

(viii) Through S draw a line parallel to $\overline{PR}$ which meet $\overline{QR}$ produced in A.

(ix) Join AP.

ΔAPQ is the required triangle equal in area to quadrilateral PQRS

3. Construct a Δ equal in area to the quadrilateral ABCD, having $m\overline{AB} = 6cm$, $m\overline{BC} = 4cm$, $m\overline{AC} = 7.2cm$, $m\angle BAD = 105^o$ and $m\overline{BD} = 8cm$.



Given

Parts of the quadrilateral ABCD are given

Required

(i) To make the quadrilateral ABCD.

(ii) To make a Δ with area equal to that of quadrilateral ABCD.

Construction

(i) Take $m\overline{AB} = 6cm$.

(ii) Make $\angle A = 105^o$.

(iii) With B as centre draw an arc of radius 8cm, cutting the arm of $\angle A$ in D.

(iv) With A as centre draw an arc of radius 7.2cm, with B as centre draw an arc of radius 4cm, cutting the first in C. Join C with B and D.

ABCD is the required quadrilateral.

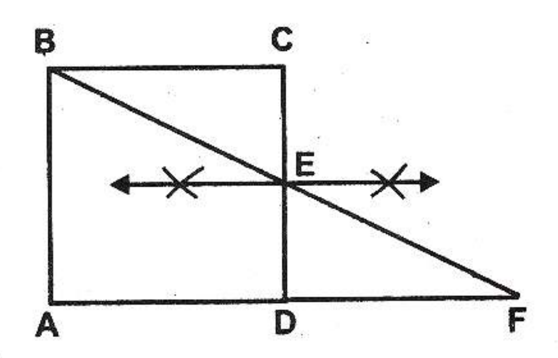
(v) Join AC.

(vi) Join DB. Draw a line parallel to $\overline{DB}$ which meet $\overline{AB}$ produced in P.

(vii) Join PD.

ΔADP is the required triangle equal in area to the quadrilateral ABCD.

4. Construct a right-angled triangle equal in area to a given square.



Given

Square ABCD

Required

To make a right-angle Δ equal in area to the square.

Construction

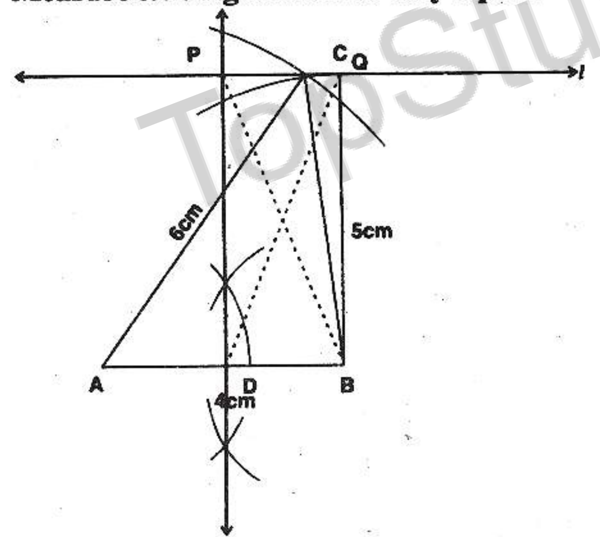
(i) Bisect $\overline{CD}$ at E.

(ii) Join BE and produce it to meet $\overline{AD}$ produced in F.

ΔABF is the required triangle equal in area to square ABCD.

Exercise 17.4

1. Construct a Δ with sides 4 cm, 5 cm and 6 cm and construct a rectangle having its area equal to that of the Δ. Measure its diagonals. Are they equal?



Given

4cm, 5cm, 6cm the sides of the triangle Δ.

Required

To make a rectangle with area equal to that of the Δ.

Construction

(i) Draw $\overline{AB} = 4cm$.

(ii) Draw an arc of radius 5cm with centre B and an other arc of radius 6cm with centre A cutting the first in C.

(iii) Join CA, CB

(iv) ABC is the required Δ.

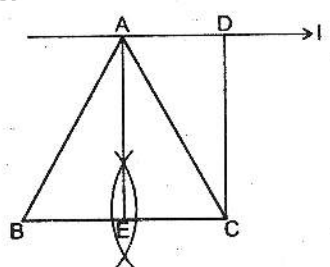
(v) Draw a line ℓ through C $\parallel$ $\overline{AB}$.

(vi) Draw the $\perp$ bisector of $\overline{AB}$ in D and cutting the line ℓ at P.

(vii) Draw BQ $\perp$ on the line ℓ.

PQDB is the required rectangle.

2. Transform an isosceles Δ into a rectangle.



Construction

(i) Take a line $\overline{BC}$

(ii) Draw the ⊥ bisector of $\overline{BC}$ take any point A on it.

(iii) Join AB and AC.

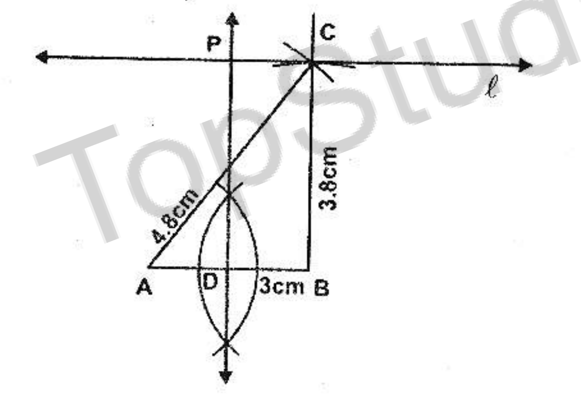
(iv) ΔABC is the isosceles Δ with $m\overline{AB} = m\overline{AC}$.

(v) Through A draw a line $\ell \parallel BC$.

(vi) Draw $\overline{CD} \perp \ell$

CDAE is the required rectangle equal in area to ΔABC

3. Construct a ΔABC such that $m\overline{AB}=3cm$, $m\overline{BC}=3.8cm$, $m\overline{AC}=4.8cm$. Construct a rectangle equal in area to the ΔABC, and measure its sides.



Given

Three sides of the ΔABC

Required

To construct a rectangle with area equal to that of the ΔABC.

Construction

(i) Take $m\overline{AB} = 3cm$

(ii) With B as centre draw an arc of radius 3.8cm, with A as centre draw another arc of radius 4.8cm, cutting the first in C.

(iii) Join B with C and A.

(iv) ABC is the required Δ.

(v) Through C draw a line $\ell \parallel \overline{AB}$.

(vi) Draw the ⊥ bisector of $\overline{AB}$ cutting the line ℓ in P.

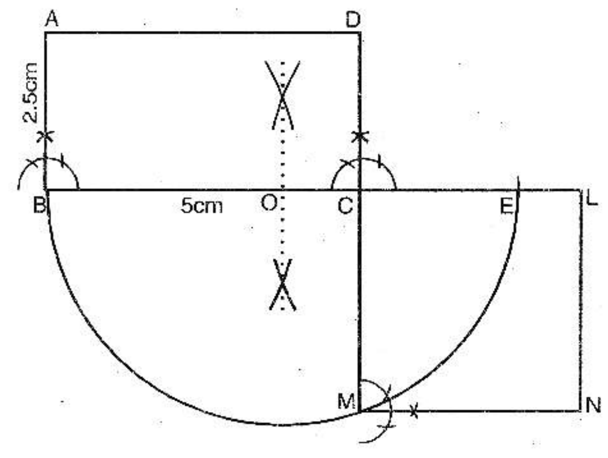
(vii) PCDB is the required rectangle.

Measures of sides of rectangle PCDB are;

$m\overline{PD} = 3.8cm$, $m\overline{DB} = 1.5cm$

Exercise 17.5

1. Construct a rectangle whose adjacent sides are 2.5 cm and 5cm respectively. Construct a square having area equal to the given rectangle.



Construction

(i) Make the rectangle ABCD with given lengths of sides.

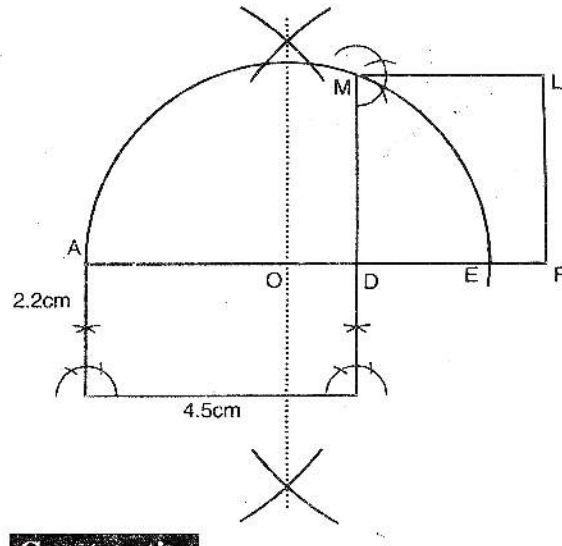
(ii) Produce $\overline{BC}$ and cut $m\overline{CE} = m\overline{CD}$

(iii) Bisect $\overline{BE}$ at O.

(iv) With O as centre and $\overline{OB}$ radius draw a semicircle cutting $\overline{DC}$ produced in M.

(v) With $\overline{CM}$ as side complete the square CMNL.

2. Construct a square equal in area to a rectangle whose adjacent sides are 4.5 cm and 2.2 cm respectively. Measure the sides of the square and find its area and compare with the area of the rectangle.



Construction

(i) Make the rectangle ABCD with given sides.

(ii) Produce AD and cut $m\overline{DE} = m\overline{DC}$.

(iii) Bisect $\overline{AE}$ at O.

(iv) With O as centre and $\overline{OA}$ radius draw a semicircle cutting $\overline{CD}$ produced in M.

(v) With $\overline{DM}$ as side complete the square DFLM.

(vi) Side of the square (average) = 3.15cm

Area = $3.15 \times 3.15 = 9.9\text{cm}^2$

Area of the rectangle $= 2.2 \times 4.5$

$= 9.9\text{cm}^2$ (equal to area of square)

3. In Q.2 above verify by measurement that the perimeter of the square is less than that of the rectangle.

Solution

(i) Side of the square = 3.15cm

Perimeter $P_1 = 4 \times 3.15$

$= 12.60$ cm

Sides of the rectangle are 4.5cm, 2.2cm

Perimeter $P_2 = 2(4.5 + 2.2)$

$= 2(6.7)$

$= 13.4$cm

$P_1 < P_2$ verified

4. Construct a square equal in area to the sum of two squares having sides 3 cm and 4 cm respectively.

Construction

(i) Make a right angled ΔABC with $\overline{AC} = 3cm$, $\overline{BC} = 4cm$.

(ii) Using Pythagoras theorem

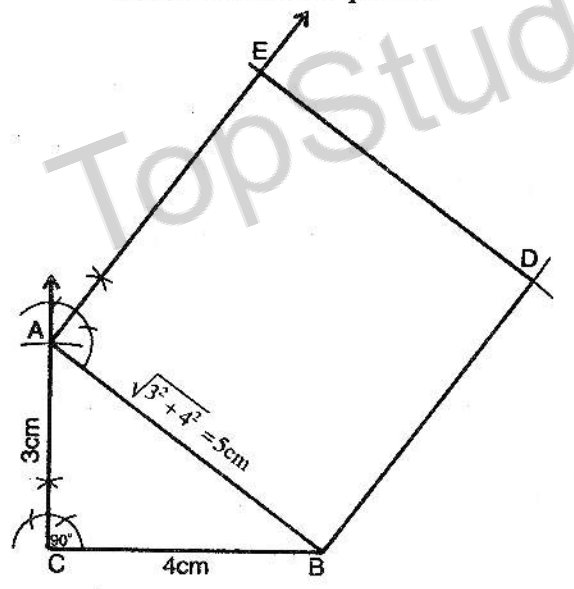
$$\sqrt{|AC|^2 + |BC|^2} = \sqrt{|AB|^2}$$

$$\sqrt{(3)^2 + (4)^2} = \sqrt{|AB|^2}$$

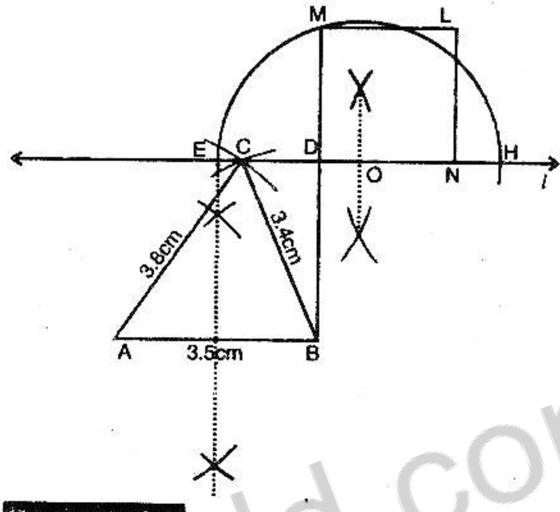
$$5cm = |AB|$$

(ii) With $\overline{AB}$ as side make square ABDE.

(iii) ABDE is the required area of square equal in area to the sum of the areas of two squares.



5. Construct a Δ having base 3.5 cm and other two sides equal to 3.4 cm and 3.8 cm respectively. Transform it into a square of equal area.



Construction

(i) Make the ΔABC with the given sides.

(ii) Draw the ⊥ bisector of $\overline{AB}$ and a line ℓ through C ∥ $\overline{AB}$ cutting each other in E.

(iii) Draw $\overline{BD} \perp \ell$.

(iv) BDEF is a rectangle.

(v) Produce $\overline{ED}$, cut $\overline{DH} = \overline{DB}$.

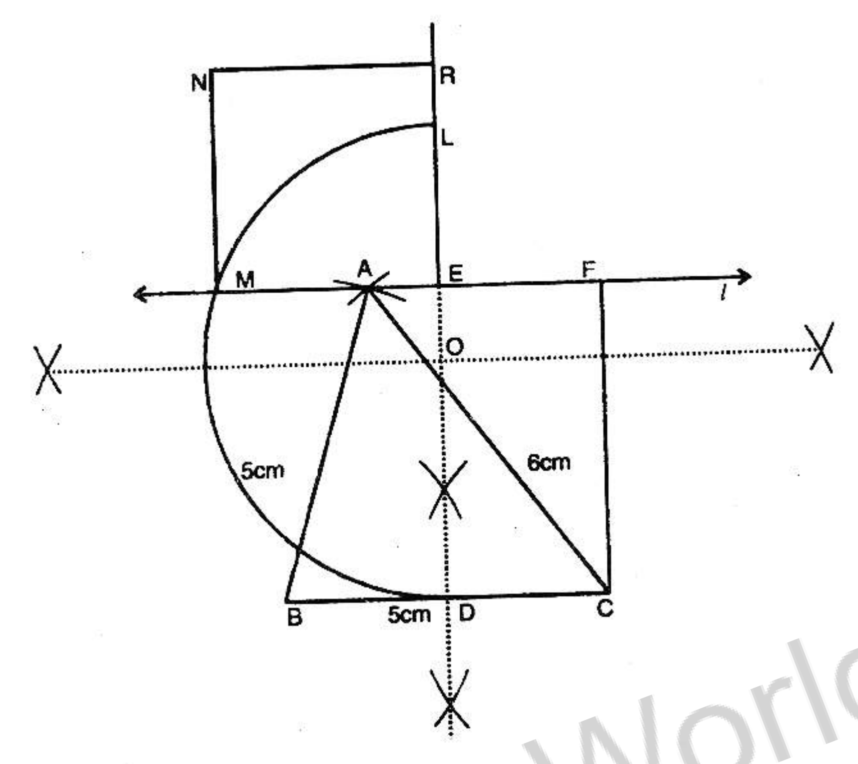
(vi) Bisect $\overline{EH}$ at O.

(vii) With O as centre and $\overline{OE}$ radius draw a semicircle cutting $\overline{BD}$ produced in M.

(viii) With $\overline{DM}$ as side, complete the square DNLM.

This is the required square equal in area to ΔABC.

6. Construct a Δ having base 5 cm and other sides equal to 5 cm and 6 cm. Construct a square equal in area to given Δ.



Construction

(i) Draw $\overline{BC} = 5cm$.

(ii) Draw an arc of radius 6cm with centre C and another arc of radius 5cm with centre B cutting first in A.

(iii) Through A draw a line $\ell \parallel BC$.

(iv) Draw the $\perp$bisector of BC cutting the line ℓ in E.

(v) Draw CF $\perp$ on ℓ. CDEF is the rectangle.

(vi) Produce $\overline{DE}$ and cut $\overline{EL} = \overline{EF}$, bisect $\overline{DL}$ at O.

(vii) Draw a semicircle with centre O and radius $\overline{OL} = \overline{OD}$, cutting l in M.

(viii) Draw a square EMNR with side EM.

This is the required square equal in area to ΔABC.

OBJECTIVE

1. A triangle having two sides congruent is called: ___
   (a) Scalene (b) Right angled
   (c) Equilateral (d) Isosceles

2. A quadrilateral having each angle equal to 90° is called ____
   (a)Parallelogram (b)Rectangle
   (c)Trapezium (d) Rhombus

3. The right bisectors of the three sides of a triangle are ___
   (a)Congruent (b) Collinear
   (c)Concurrent (d) Parallel

4. The __ altitudes of an isosceles triangle are congruent:
   (a)Two (b) Three
   (c)Four (d) None

5. A point equidistant from the end points of a line segment is on its __

(a)Bisector (b)Right bisector

(c)Perpendicula (d) Median

6. ___ congruent triangles can be made by joining the mid points of the sides of a triangle:

(a)Three (b) Four

(c)Five (d) Two

7. The diagonals of a parallelogram ___ each other:

(a)Bisect (b) Trisect

(c)Bisect at right angle

(d) None of these

8. The median of a triangle cut each other in the ratio:

(a)4:1 (b) 3:1

(c)2:1 (d) 1:1

9. One angle on the base of an isosceles triangle is 30°. What is the measure of its vertical angle:

(a)30° (b) 60°

(c)90° (d) 120°

10. If the three altitudes of a triangle are congruent then the triangle is __

(a)Equilateral (b) Right angled

(c)Isosceles (d) Acute angled

11. If two medians of a triangle are congruent then the triangle will be:__

(a)Isosceles (b) Equilateral

(c)Right angled (d) Acute angled

12. A line segment joining a vertex of a triangle to the midpoint of its opposite side is called a ___ of the triangle:

(a)Altitude (b) Median

(c)Angle bisector (d) Right bisector

13. A line segment from a vertex of triangle perpendicular to the line containing the opposite side, is called an __ of the triangle:

(a)Altitude (b) Median

(c)Angle bisector (d) Right bisector

14. The point of concurrency of the three altitudes of a Δ is called its ___

(a)Ortho centre (b) In centre

(c)Circum centre (d) None

15. The internal bisector of the angle of a triangle meet at a point called the _______ of the triangle:

(a)In centre (b) Ortho centre

(c)Circum centre (c) None

16. The point of concurrency of the three perpendicular bisectors of the sides of a triangle is called the _____ of the triangle.

(a) Circum centre (b) In centre

(c) Ortho centre (d) None

ANSWER KEY

1.	d	2.	b	3.	c	4.	a	5.	b
6.	b	7.	a	8.	c	9.	d	10.	a
11.	a	12.	b	13.	a	14.	a	15.	a
16.	a								